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# Measuring the effects of central softening of drinking water in households and industries in Brøndby, Denmark

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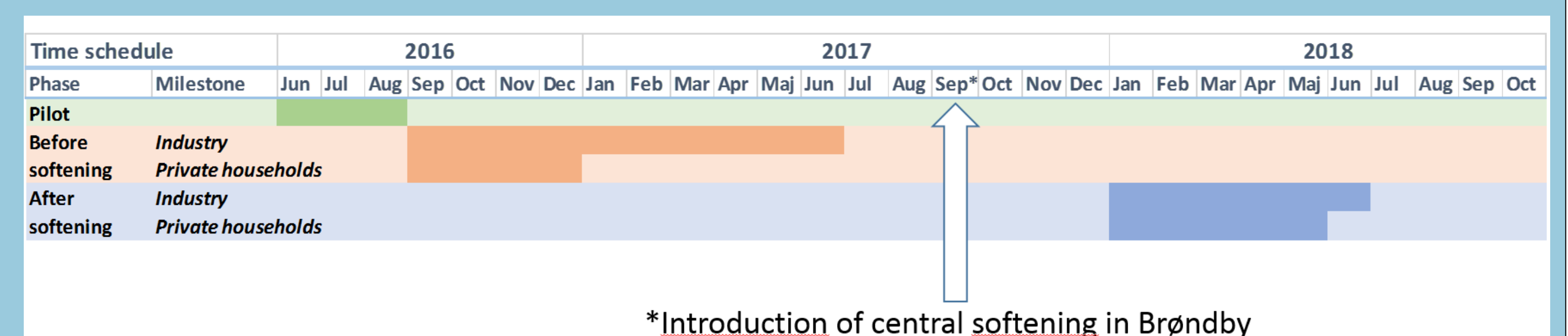
## Introduction

- Drinking water hardness affects the economy, environment and convenience experienced by the water user
- We want to provide actual measurements of the effects before and after introducing central softening in Brøndby, Copenhagen
- In Denmark economic cost-benefit analysis (CBA)<sup>1,2</sup> and environmental life-cycle assessment (LCA)<sup>3</sup> show significant benefits from introducing central softening at waterworks where water hardness levels are above 250 mg/L as CaCO<sub>3</sub>
- Most CBA and LCA conclusions are based on theoretical assumptions

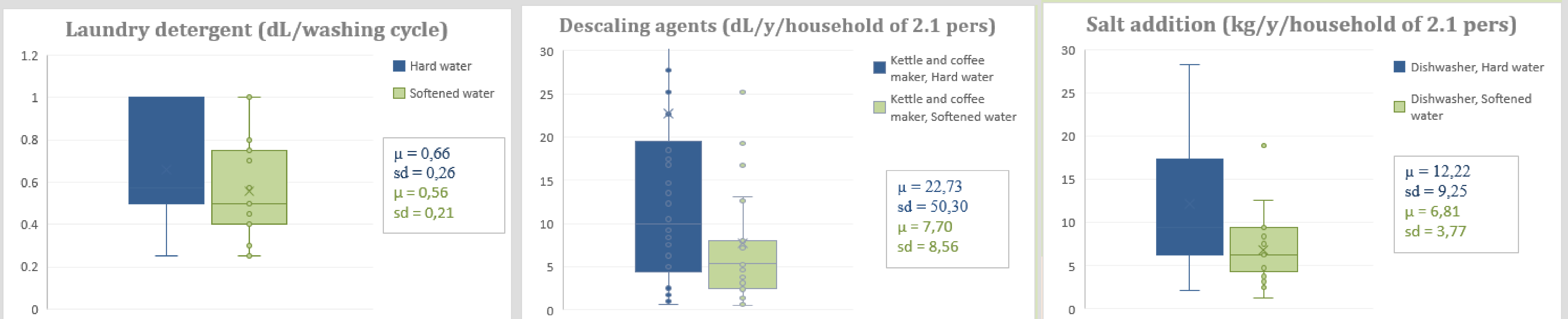


## Methods and participants in the project

- Measurements are carried out *before* (371 mg/L) and *after* (205 mg/L) introducing central softening. A comparison of the two set of measurements shows the effects of water softening
- Participants and measurements:
  - 30 private households: Consumption of descaling agents, dishwasher salt, laundry detergents, fabric softener, time for removing scaling
  - 4 Industries: Water heating efficiency, salt consumption (ion exchanger), precipitation in tap aerators and toilet cisterns

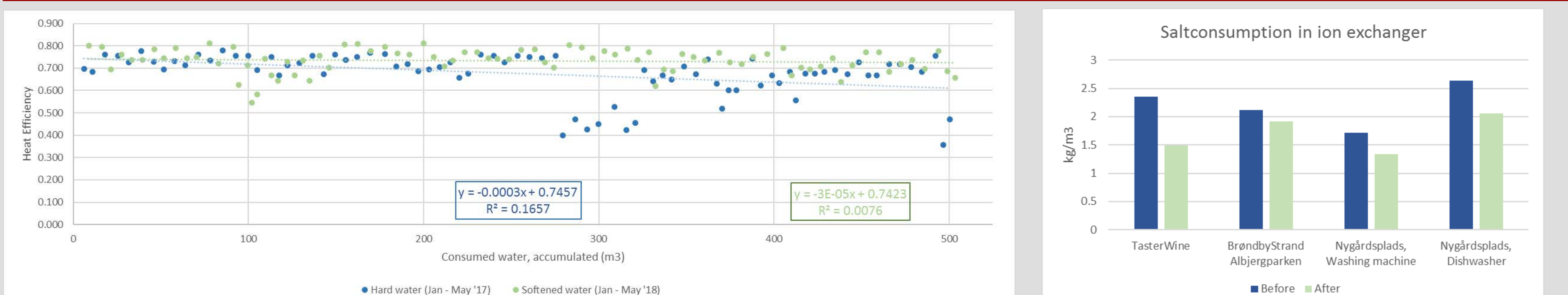


## Preliminary results – Private households



Consumption of: laundry detergent; descaling agents for kettle and coffee maker; and salt addition in dishwasher is reduced with softened water

## Preliminary results - Industries



Efficiency of one central heating installation *before* and *after* softening  
Heat efficiency decreases 0.8% with softened water compared to 8% with very hard water during a 4 month period between services.

Consumption of salt for decentralised water softening devices is decreased



<sup>1</sup>COWI (2011). Central blødgøring af drikkevand.

<sup>2</sup>Rambøll (2017). Blødt vand i en cirkulær økonomi.

<sup>3</sup>Godskesen et al. (2012). Life cycle assessment of central softening of very hard drinking water. *J.env.man.* (105) 83-89